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AN EVALUATION OF COMMON PREDICTORS OF
CONSUMER ACCEPTANCE

Army Natick Laboratory

April 1973

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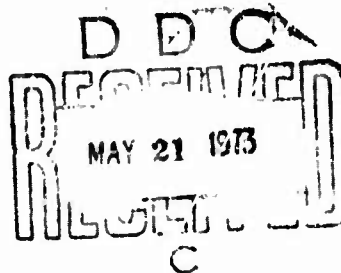
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by



Laurence G. Branch

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13. ABSTRACT Three commonly used predictors (a lengthy paper and pencil questionnaire completed by the target consumers; an abbreviated paper and pencil questionnaire completed by a similar group; and acceptance laboratory foods rated by an experienced panel) of consumer reactions to foods in the situation were compared on nine foods. The ratings on five of the foods were significantly different as a function of the type of measurement. Further analyses revealed that each type of measurement was inconsistent with the others in one or two instances. None of the traditional predictors was exceptionally more accurate or less accurate than the others; the intercorrelations between the predictors and the criterion are interpreted as demonstrating the need for basic research in the food service industry.			

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CONSUMER ACCEPTANCE**

by

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The views expressed, however, are solely those of the author, and not of the Department of the Army.

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INTRODUCTION

During 1970 American consumers paid over \$19 billion to the 400 largest organizations within the food service industry for away-from-home foods (Institutions, 1971). Furthermore, the U.S. Army provided its military consumers with meals valued at \$1,223.7 million through its food service system; while the Navy, Air Force, and Marine Corps provided their consumers with \$577.7, \$280.6, and \$248.6 million respectively in food service. As a whole, the Department of Defense (DOD) provided \$2,330.3 million in food service to its consumers, which represented over 12% of all food service expenditures for away-from-home foods during 1970 (Institutions 1971). DOD therefore accounted for a significant proportion of the volume within the food service industry.

The food service industry has increasingly used the services of scientific professionals to research and develop marketable food products in the attempt to secure even a small percentage of these consumer dollars. The understanding and prediction of consumer preferences and consumer acceptance is one aspect of industrial research and development in which nearly every organization requests behavioral science assistance, such as the research initiated in Chicago at the Quartermaster Corps Food and Container Institute and continued at Natick in the U.S. Army Laboratories.

The definitions of the terms "consumer preference" and "consumer acceptance" are not uniformly agreed upon. For the present study, the term "consumer preference" refers to the consumers' general likes and dislikes for foods (i.e., consumers generally like fried chicken better than Swiss steak and french fried potatoes better than hash browned potatoes); whereas the term "consumer acceptance" refers to the consumers' reaction to a specific food item (i.e., this meat loaf, with its specific ingredients, specific method of preparation, and specific serving temperature, is accepted by the consumer to such and such a degree). Consumer preferences are usually measured by paper and pencil

questionnaires in which the respondent indicates his degree of preference to a word name; consumer acceptance is obtained from the respondent's reaction to the actual food item. Consumer acceptance measures are obtained typically from an experiment or laboratory kitchen of some sort, or from the actual field situation.

The rationale underpinning the use of preference data and laboratory acceptance data is straightforward enough: these data are assumed to be predictors of field acceptance. Notwithstanding are the realities that the groups and the stimuli used to generate the data are usually different, as will be apparent in the method section.

The degree of correspondence between the paper and pencil responses and the field consumer acceptance, as well as the correspondence between laboratory consumer acceptance and field consumer acceptance, is important to both the consumer and the food service industry. It is critical to the individual consumer because the industrial research he is ultimately financing will determine the types of foods he is offered, and it is critical to the organizations within the food service industry because each wants to gather information about what foods to develop in order to maximize their percentage of consumer dollars.

In determining the degree of correspondence between these various predictors and field acceptance, the behavioral scientist is hauntingly cognizant of the classical work of LaPiere (1934), in which the stated attitudes of hotel managers did not correspond with their actual behavior in 60 out of 65 instances. Since LaPiere published his findings, the theoreticians of attitude measurement have devoted considerable effort in attempting to unravel this somewhat entangled phenomenon. Notwithstanding the important contribution of Fishbein (1967), who attempted to elucidate the problems embedded therein, it is nevertheless advisable to approach the basic question of the degree of correspondence as an empirical problem and therefore make no precarious assumptions or predictions.

The present study compares two types of consumer preference information and one type of laboratory consumer acceptance information with field consumer acceptance information on nine food items. Each of these four sources of information was obtained in connection with the DOD food service program, which was attempting to attract the nearly 50% of its potential consumers who were not obtaining their meals through their food service system. The ideal protocol followed by the DOD food service program is the same as is followed by many other organizations within the industry: first, the potential consumers are requested to indicate the degree to which they liked or disliked certain foods by means of a paper and pencil questionnaire; second, food technologists attempt to improve those highly preferred foods in the experimental kitchens and gauge their results by the laboratory consumer acceptance scores; and third, the foods improved in this consumer acceptance laboratory are tried in the field situation and consumer acceptance scores therein obtained.

Method

Group 1: The Lengthy Food Preference Survey.

The Stimulus. The lengthy Food Preference questionnaire consisted of 416 randomly listed food items chosen primarily from the Armed Forces 42 Day Menu. Each respondent was asked to rate all food items on two different food preference scales, first a preference frequency scale and second the traditional nine-point hedonic scale. The preference frequency scale required each person to indicate HOW OFTEN he would like to eat a particular food (in terms of desired servings/week and the number of weeks per month) for each meal. The survey format also permitted him to indicate that he never wanted a particular food item or that he had never heard of it. The nine-point hedonic scale required each respondent to indicate his degree of like or dislike for each food item;

the scale range was from 1 (dislike extremely) through 9 (like extremely). This questionnaire was printed on mark-sense sheets for automated data reduction. The average respondent required ninety minutes to complete the questionnaire. Only the hedonic values of 9 food items are considered in this present study. These food items are: lasagna, Swedish meatballs; bar b q beef cubes; breaded veal steak, beef stew, sloppy Joe; french toast; Swiss steak; and oven fried chicken.

The Subjects. The Ss in this group were 573 consumers of the target dining facilities at Fort Lewis, Washington. Originally 689 consumers were administered the forms, but 116 forms were deleted because: a) 42 were incomplete (6.1%); b) 37 were not scored because the Ss were uncooperative (5.4%); and c) another 37 were eliminated on the basis of three reliability checks (5.4%). The reliability checks were based upon: a) average individual discrepancies in the hedonic ratings of five duplicate food items inserted in the questionnaire; b) average individual discrepancies in the desired frequency ratings of these same duplicate items; and c) average individual correlation coefficients between hedonic scores and frequency scores within specific sub classes of foods. The distribution of individual outcomes were plotted for each criterion, and individuals falling below the tenth centile were identified for each. Those individuals falling in this critical region on two of the three criteria were eliminated.

These Ss completed the questionnaire in groups of 20 to 50, with 4 to 6 supervisors present at each session.

A detailed description of the background and opinions toward the U.S. Army food service system of these consumers, as well as an exhaustive discussion of the sampling method and procedures used, can be found in a report by Kiess *et al.* (1972). A detailed description of the food preferences of these consumers for all the food items can be found in a report by Meiselman *et al.* (1972).

Group 2: The Abbreviated Food Preference Survey.

The Stimulus. The shortened Food Preference questionnaire consisted only of the names of ten food items (the nine previously listed and Salisbury steak, which was not included in the analysis because of insufficient sample size in group 4). The Ss were requested solely to indicate their hedonic ratings on the traditional nine point scale. The nine items were chosen specifically to correspond to the foods which were evaluated in the experimental laboratory kitchen of the U.S. Army Laboratories in Natick, Massachusetts. The instructions for completing this questionnaire were taken verbatim from the instructions for hedonic ratings of the lengthy Food Preference questionnaire. Less than 5 minutes were required to complete the form.

The Subjects. The Ss in this group were 23 military consumers stationed at the U.S. Army Laboratories in Natick, Massachusetts. All Ss completed the form satisfactorily in a group administration.

Group 3: The Consumer Acceptance Laboratory Foods.

The Stimulus. The nine food samples were prepared in the acceptance laboratory according to the directives of the food technologists. In some instances the food technologists required several tests of a specific food item prior to their determination that a specific method of preparation would be adopted in the field. The present study only uses the consumer acceptance data for the method of preparation of the nine food items which was ultimately chosen for the field.

The serving of these samples in the acceptance laboratory was in accordance with the standard procedures of the industry. Specifically, the proper serving temperature is maintained during the test; the type of vessel commonly employed in serving the item is used; and the sample quantity is less than a typical serving.

The total time period required to conduct a laboratory acceptance test of a particular food item is kept at one hour or less to avoid quality changes in the foods, particularly in foods held hot.

The laboratory acceptance tests are conducted in a temperature and odor controlled room, in which a serving counter is partitioned to accommodate six individual Ss participating simultaneously. Each individual booth has a mouth rinse facility which the S uses before and after tasting the sample. Each booth is serviced by a hood through which the food samples and coded IBM rating cards (on which are printed a single hedonic scale) are passed; this procedure obviates all server and S interaction. After the S tastes the food sample, both the completed rating card and the serving vessel are passed back to the server by means of the hood.

Detailed information on the procedures followed by this acceptance laboratory can be found in the Manual on Sensory Testing Methods (1968).

The Subjects. All civilian ($n \approx 1500$) and military ($n \approx 100$) personnel at the Natick Laboratories are asked to participate in "taste testing"; 600 volunteers were on the taste panel roster during the present study. The names and office extension numbers of these Ss are listed in a random sequence (by means of computer). Ss are telephoned at the start of a taste test session as their names appear on the list. A different group of 24 Ss evaluated each of the nine food items.

Group 4: Consumer Acceptance in the Field.

The Stimulus Situation. The stimuli rated by this group were again actual food items. During the initial 11 weeks of implementation of the U.S. Army model food service system at Fort Lewis, Washington, 2471 personal interviews were conducted to ascertain the consumer reaction to 26 aspects of the model food service system and in

addition the consumer acceptance ratings for each food item which each consumer ate during the meal for which he was interviewed. Each interview required about 10 minutes to conduct. Detailed information on the consumers' reactions to all of these elements may be found in a report by Branch and Meiselman (1972), but the present study is concerned only with the consumers' hedonic ratings on the traditional 9-point scale of the nine food items which were evaluated in the acceptance laboratory. These nine food items were all centrally prepared and then transported and reheated at the particular dining facility within the model food service system.

The Subjects. The 2471 individual interviews were again obtained solely from military consumers at Fort Lewis participating in the model food service system. This S population numbered about 1200, hence some Ss responded up to 4 different times across the whole 11 week period.

Results and Discussion

Table 1 presents the mean hedonic rating for each of the nine food items for each of the four groups. In addition, Table 1 indicates the significance level obtained from a one way ANOVA for each food item (each row of the table). The results of the ANOVA demonstrated that in five of nine instances the hedonic ratings were significantly different as a function of how the ratings were obtained. At this point the strict experimentalist within us all is straining to point out that the four groups differ on many dimensions as stated in the method section (groups 1 and 2 are responding to food names, 3 and 4 to actual food items; 1 and 4 have Fort Lewis military as subjects, 2 has Natick Laboratories military, 3 has a predominately civilian and experienced panel; 1 and 4 responded to many more items than these now under consideration, 2 and 3 did not), therefore it is impossible to ferret out the reasons for these differences and foolhardy

Table 1

**Mean Hedonic Values of the Nine Food Items for Each Type of Measurement
and the ANOVA Significance Levels Across the Items**

Food Items	Type 1 The Lengthy Food Preference Scale	Type 2 The Short Food Preference Scale	Type 3 The Acceptance Laboratory	Type 4 The Field Kitchen	ANOVA Signifi- cance Level
Lasagna	5.59 (514)	6.96 (23)	6.71 (24)	6.91 (47)	.001
Swedish Meatballs	5.76 (504)	5.74 (23)	7.46 (24)	7.21 (63)	.001
Bar B Q Beef Cubes	6.14 (521)	5.70 (23)	7.33 (24)	6.03 (32)	.05
Breaded Veal Steak	6.33 (532)	6.57 (23)	6.88 (24)	6.59 (22)	NS
Beef Stew	6.36 (548)	6.30 (23)	7.08 (24)	6.82 (44)	NS
Sloppy Joe	6.51 (554)	5.61 (23)	6.50 (24)	7.13 (55)	.025
French Toast	6.79 (540)	6.48 (23)	7.75 (24)	6.81 (129)	NS
Swiss Steak	6.93 (551)	6.30 (23)	6.58 (24)	6.77 (26)	NS
Oven Fried Chicken	7.43 (538)	7.87 (23)	7.92 (24)	6.78 (88)	.005

NOTE: The numbers in parenthesis refer to the sample size.

to progress further. However, the behavioral scientist assisting the food service industry must make predictions based on information produced by groups similar to the first three groups in the present study, therefore this information is critical for him.

Table 2 presents the significance levels obtained from multiple *t*-tests calculated on the mean hedonic value of each of the 5 food items which the ANOVA revealed were significantly different as a function of the particular form of measurement used to generate the hedonic value of the food. For lasagna, the data demonstrate that the lengthy food preference questionnaire yielded data which is at variance with the other three forms of measurements. For Swedish meatballs, both measures of food item names corresponded, while both measures of actual food items corresponded, but the measures of food names significantly differed from the measures of actual foods. For bar b q beef cubes, the data from the acceptance laboratory significantly differed from the three other measures. For sloppy Joe's, the data from the acceptance laboratory did not significantly differ from any of the other three measures, but each of the other three did significantly differ with each other. For oven fried chicken, the lengthy and the short preference scales and the acceptance laboratory each do not differ from the others, but the data from the field consumers did significantly differ from each of the other three measures.

The data concerning chicken raises an additional point. It is generally assumed that the consumer reaction in the field setting is the "criterion" for the predictors, but this "criterion" is not invariant and might be affected by factors operative in the field (e.g., the food preparer might err; the raw product might occasionally be inferior).

In summary, Table 2 demonstrates that the lengthy preference questionnaire was out of sequence once, the acceptance laboratory was out of sequence once, the field or "criterion" group was out of sequence once, and the food word measures were out of

Table 2

Significance Levels Generated by Multiple *t*-Tests for the Food Items as a Function of Type of Measurement¹

Food Items	Type 1 The Lengthy Food Preference Scale	Type 2 The Short Food Preference Scale	Type 3 The Acceptance Laboratory	Type 4 The Field Kitchen
Lasagna				
Type 1	--	.025	.05	.001
Type 2		--	NS	NS
Type 3			--	NS
Swedish Meatballs				
Type 1	---	NS	.001	.001
Type 2		--	.001	.001
Type 3			--	NS
Bar B Q Beef Cubes				
Type 1	--	NS	.01	NS
Type 2		--	.001	NS
Type 3			--	.005
Sloppy Joe				
Type 1	--	.05	NS	.05
Type 2		--	NS	.001
Type 3			--	NS
Oven Fried Chicken				
Type 1	--	NS	NS	.005
Type 2		--	NS	.01
Type 3			--	.005

¹ Due to the repeated use of the *t*-test, the probability of rejecting a true null hypothesis is increased.

sequence with the actual food measures once. Clearly no predictor has yet emerged superior when scrutinizing the food items as a function of the type of measurement.

However, although none has emerged superior, the data can still be interpreted as demonstrating that none has emerged inferior either. Thus far, each predictor was *not* significantly different in four of the nine original food items, and further analysis has demonstrated that each predictor was out of sequence in only one or two instances.

Table 3 restructures the information presented previously in order to demonstrate which types of hedonic measurements correspond most closely with the other types. Across the 5 food items, the lengthy preference scale corresponds most closely with the short preference scale, then with the laboratory acceptance data, and least with the field acceptance data. The short preference scale corresponds most with the lengthy preference data, then with the acceptance laboratory, and least with the field. The acceptance laboratory corresponds most with the field, then with the short preference data, and least with the lengthy preference data. The field data corresponds most closely with the laboratory acceptance data, then with the short preference scale, and least with the lengthy preference information. One way of interpreting this information is that the food industry can obtain greater consumer acceptance by marketing foods which already have highly acceptable recipes and preparation methods. The alternative of trying to determine consumer preferences and then marketing a product solely to conform to preferences is riskier.

Table 4 presents the Pearson product-moment correlations between the four types of measurements across all 10 food items. Although none of the reported correlations was significantly different from zero, the cause is due more to small sample size of food items than to the magnitude of r and r^2 . Furthermore, it should be remembered that

Table 3

Significance Levels Generated by Multiple *t*-Tests for the Type of Measurement as a Function of the Food Items¹

Type of Measurement	Type 1 The Lengthy Food Preference Scale	Type 2 The Short Food Preference Scale	Type 3 The Acceptance Laboratory	Type 4 The Field Kitchen
Type 1				
Lasagna	--	.025	.05	.001
Swedish Meatballs	--	NS	.001	.001
Bar B Q Beef Cubes	--	NS	.01	NS
Sloppy Joe	--	.05	NS	.05
Oven Fried Chicken	--	NS	NS	.005
Type 2				
Lasagna		--	NS	NS
Swedish Meatballs		--	.001	.001
Bar B Q Beef Cubes		--	.001	NS
Sloppy Joe		--	NS	.001
Oven Fried Chicken		--	NS	.01
Type 3				
Lasagna			--	NS
Swedish Meatballs			--	NS
Bar B Q Beef Cubes			--	.005
Sloppy Joe			--	NS
Oven Fried Chicken			--	.005

¹Due to the repeated use of the *t*-test, the probability of rejecting a true null hypothesis is increased.

the mean hedonic value of the food, which is the actual number used to compute the correlation, is more stable than typical values used in correlations because the mean was based on many responses. For these foods therefore, the correlations should be quite stable. The correlations in Table 4 demonstrate that none of the assumed "predictors" are superior to the others, and in fact all are less than adequate.

In the face of these data, it is apparent that the research and development area of the food service industry should not be satisfied with the traditional predictors of consumer acceptance in the field. Validation studies similar to the present study need to be conducted on certain of the less frequently used predictors of consumer food behavior, such as food choices. In this technique, the predictor is usually a consumer's paper and pencil responses to the question of how often he would like to eat certain food items; the criterion is how often he actually does consume the specific food items. This research is not as straightforward as it immediately seems, however, because the criterion situation is usually confounded by the violation of the assumption of equal availability of all the food items.

Table 4

Correlations Between the Four Types of Measurements Across Nine Food Items

	Type 1 The Lengthy Food Preference Scale	Type 2 The Short Food Preference Scale	Type 3 The Acceptance Laboratory	Type 4 The Field Kitchen
Type 1	---	.48	.34	.08
Type 2		---	.38	.01
Type 3			---	.15

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